## 6.1 BSAI Groundfish

Recommendations for Identification and Description
of Essential Fish Habitat for the Groundfish Resources
of the Gulf of Alaska,
Bering Sea, and Aleutian Islands Regions

by
The Technical Team for Essential Fish Habitat
for the Groundfish Resources of the Alaska Region

### Background

The Essential Fish Habitat Assessment Reports (NPFMC 1997a;b) provide summaries and assessments of habitat information for Gulf of Alaska and Bering Sea and Aleutian Islands Region Groundfish species. The team reviewed habitat descriptions and life history information summarized by stock assessment scientists and determined the levels of information available for each life stage of major species in the BSAI and GOA FMPs. The information contained in these summaries along with that contained in data atlases (NOAA 1987; 1990), summaries of fishery and survey data (Allen and Smith 1988; Wolotira et al. 1993; Fritz et al. In press a;b), and fish identification books (Hart 1973; Eschmeyer and Herald 1983) were used to determine the level of knowledge available to identify EFH for each life stage of each major groundfish species. In evaluating the level of knowledge available, the technical team defined a level 0 as a subset of level 1 as defined by NMFS in its guidelines for determining the level of information on the distribution of a life stage. For life stages of BSAI and GOA groundfish, the Team determined that information of level 0, 1, and 2 was available.

From this information, ***general distributions*** of species life stages were defined. A general distribution of a species' life stage is a subset of its current and historic range, and is the geographic area containing most (approximately 95%) of the individuals across all seasons. Habitats occupied by the species' life stage are located within each general distribution. Rare observations that extend a species range during anomalous environmental conditions would not be considered part of its general distribution.

> For life stages with information levels 1 and 2, *general distributions* were determined geographically as the area encompassing at least 95 percent of positive survey samples in Fritz et al. (In press, a;b) and supplemented as necessary by distribution information available in NOAA (1987;1990), Wolotira et al. (1993), and Allen and Smith (1988) to allow for survey coverage limitations, and by any relevant knowledge of life history or habitat associations. Maps illustrating general distributions for species life stages for which level 1 or 2 is available are provided.
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> For life stages with level 0 information, *general distributions* were inferred from where a species has been observed and any relevant knowledge of its life history and habitat associations. No maps for life stages with level 0 information were drawn.

Areas of ***known concentrations*** within a general distribution were also defined as the approximate area encompassing survey or fishery hauls with density (catch per unit effort) observations in the upper 66th percentile of positive observations of a species life stage in Fritz et al. (In press a;b), and supplemented as necessary by distribution information available in NOAA (1987;1990), Wolotira et al. (1993), and Allen and Smith (1988) to allow for survey coverage limitations, and by any relevant knowledge of life history or habitat associations. *Known concentrations* are defined only for species life stages for which level 2 knowledge is available (only for the adult stages of certain groundfish) and are shown on the accompanying maps.

**Recommendations for Identification and Description of Groundfish EFH**

The Groundfish Technical Team considered the alternatives of using general distribution or known concentrations to define EFH for species' life stages for which level 2 information was available. The Team's principal concern was that using known concentrations alone to designate EFH would not ensure that adequate areas were protected as EFH. Specific reasons discussed by the Team in support of this conclusion were:

1. Areas of known concentrations based on current information do not adequately address unpredictable annual differences in spatial distributions of a life stage, nor changes due to long term shifts in oceanographic regimes.

   Annual differences in distribution of high concentrations of adults, particularly for pelagic or semi-demersal species (e.g., pollock, Pacific cod) occur and are unpredictable. Within the last 20 years, from which most data has been obtained, long term changes in concentrations have been observed in Alaska groundfish. The spawning distribution of Gulf of Alaska pollock has changed dramatically since the 1970's. Relative distribution of the Alaska sablefish stock between the BS, AI, and GOA has cycled since the late 1970's.

2. All habitats occupied by a species contribute to production at some level. Although contributions from individual locations may be small, collectively they can account for a significant part of total production.

3. A stock's long term productivity is based on both high and low levels of abundance and the entire general distribution may be required during times of high abundance

4. There is a seasonal limitation on survey information (chiefly summer) upon which descriptions of known concentrations are primarily based, while the general distribution is based on the best available scientific information, as well as fishery and local knowledge of a species life stage.

5. There is no discrete basis for the distinction between known concentrations and general distribution of a species' life stage.

6. Observed concentrations or densities do not necessarily reflect all habitat essential to maintain healthy stocks within the ecosystem.

The advice in the NMFS guidelines to use risk-averse and ecosystem approaches and the best scientific information available suggests that the general distribution should be used to designate EFH necessary to maintain healthy stocks and ecosystems and sustain productive fisheries. While areas of known concentration are identified for some species life stage, the Groundfish Technical Team recommends that EFH be defined at this time as the general distribution for all groundfish species life stages in the Gulf of Alaska, Bering Sea and Aleutian Islands.

The recommended EFH definition for each species' life stage is written in the following section and described in Tables 1-3. The habitats described in the text are located within the general distributions shown on maps for species' life stages with level 1 or 2 information. For those stages with level 1 information, only general distributions within which EFH is located are drawn on maps. For those adult groundfish with level 2 information, known concentrations are also drawn on the maps within the general distribution, however EFH is defined as the adult's general distribution. No maps are provided for those life stages with level 0 information.

For BSAI and GOA pollock, a map showing the general distribution of each life stage is provided. For all other groundfish species which have level 1 or 2 information for adult or juvenile life stages, only 1 map is provided. If the adult stage has level 2 information and the juvenile stage has level 1 information, the map displays both the general distribution of adults and juveniles and known concentrations of adults. If only the adult stage has level 1 or 2 information, the map displays its general distribution and known concentrations (only for level 2).

Geographic references used in the written definitions of EFH for BSAI and GOA groundfish are shown in Figure 1. EFH distribution maps are drawn specific to the management areas of concern. For instance, maps of general distributions of BSAI groundfish show the distribution of EFH only in the BSAI region, which includes only management areas between 500-543; it is not drawn east of 170°W south of the Aleutian Islands since that is in the GOA region (management areas between 600-680; Figure 2). Similarly, EFH is not drawn beyond the boundaries of the U.S. Exclusive Economic Zone.

## References


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Wolotira, R. J., Jr., T. M. Sample, S. F. Noel, and C. R. Iten. 1993. Geographic and bathymetric distributions for many commercially important fishes and shellfishes off the west coast of North America, based on research survey and commercial catch data, 1912-1984. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-AFSC-6, 184 p.

**Figure 6.1 Geographic references used in the descriptions and identification of EFH for groundfish in the GOA and BSAI.** **(See table of contents for map)**

**Figure 6.2 NMFS management areas for the GOA and BSAI regions.** **(See table of contents for map)**

**See table of contents for the following tables:**

**Table 6.1 Summary of habitat associations for groundfish in the BSAI and GOA.**

**Table 6.2 Summary of biological associations for groundfish in the BSAI and GOA.**

**Table 6.3 Summary of reproductive traits for groundfish in the BSAI and GOA.**

**Table 6.4 References Used to Draw Maps for BSAI Groundfish**

| | **References** | | | | | |
|---|---|---|---|---|---|---|
| Species | Allen and Smith 1988 | Fritz et al. In press (a) | Fritz et al. In press (b) | NOAA 1987 | NOAA 1990 | Wolotira et al. 1993 |
| Walleye pollock | X | X | X | X | X | X |
| Pacific cod | X | X | X | X | X | X |
| Yellowfin sole | X | X | X | X | | X |
| Greenland turbot | X | X | X | X | | X |
| Arrowtooth flounder | X | X | X | X | X | X |
| Rock sole | X | X | X | X | | X |
| Alaska plaice | X | X | X | X | | X |
| Flathead sole | X | X | X | X | X | X |
| Sablefish | X | X | X | | X | X |
| Pacific ocean perch | X | X | X | | X | X |
| Shortraker-rougheye rockfish | X | X | X | | | |
| Northern rockfish | X | X | X | | | |
| Dusky rockfish | X | X | X | | | |
| Thornyhead rockfish | X | X | X | | | |
| Atka mackerel | X | X | X | | X | X |
| Sculpins | X | X | X | | | |
| Skates | X | X | X | | | |

**Table 6.5 References Used to Draw Maps for GOA Groundfish**

| Species | References | | | | |
|---|---|---|---|---|---|
| | Allen and Smith 1988 | Fritz et al. In press (a) | Fritz et al. In press (b) | NOAA 1990 | Wolotira et al. 1993 |
| Walleye pollock | X | X | X | X | X |
| Pacific cod | X | X | X | X | X |
| Dover sole | X | X | X | X | X |
| Yellowfin sole | X | X | X | | X |
| Rock sole | X | X | X | | X |
| Rex sole | X | X | X | | X |
| Flathead sole | X | X | X | X | X |
| Arrowtooth flounder | X | X | X | X | X |
| Sablefish | X | X | X | X | X |
| Pacific ocean perch | X | X | X | X | X |
| Shortraker-rougheye rockfish | X | X | X | | |
| Northern rockfish | X | X | X | | |
| Dusky rockfish | X | X | X | | |
| Yelloweye rockfish | X | X | X | | |
| Thornyhead rockfish | X | X | X | | |
| Atka mackerel | X | X | X | X | X |
| Sculpins | X | X | X | | |
| Skates | X | X | X | | |

## EFH Definition for BSAI Walleye Pollock

**Eggs(duration 14-25 days) - Level 1**
Pelagic waters of the outer continental shelf and upper slope of the eastern Bering Sea from Unimak Island northwest to Zhenchug Canyon. Also in pelagic waters (200-400 m) depth) over basin and lower slope areas in the Aleutian Islands and the Aleutian Basin. These are likely areas of upwelling or have gyres. Spawning occurs in February-April.

**Larvae (duration 60 days) - Level 1**
Epipelagic waters on the inner, middle, and outer continental shelf and upper slope throughout the eastern Bering Sea, eastern portions of the Aleutian Basin and throughout the Aleutians Islands. Survival is enhanced where food (copepod nauplii and small euphausiids) is concentrated, such as along semi-permanent fronts (mid-shelf front near the 100 m isobath) in the eastern Bering Sea, within ephemeral gyres, and possibly in association with jellyfish.

**Juveniles (up to 4 years) - Level 1**
Throughout the eastern Bering Sea and the Aleutian Islands both pelagically and on-bottom (no known substrate preferences) throughout the inner, middle, and outer shelf regions. At ages 2 and 3 years, pollock are located off-bottom within the water column, principally in the middle and outer shelf regions northwest of the Pribilof Islands. Ranges of juveniles of strong year-classes have varied from throughout the eastern Bering Sea (1978 year-class) to almost exclusively north of Zhenchug Canyon (1989 year-class). Feeding areas contain pelagic crustaceans such as copepods and euphausiids.

**Adults (4+ years old) - Level 2**
Meso-pelagic and semi-demersal habitats (no known substrate preferences) along the middle and outer continental shelf in the eastern Bering Sea from the U.S. Russia Convention Line to Unimak Pass and northeast along the Alaska Peninsula and throughout the Aleutian Islands. Also exists pelagically over deep Aleutian basin waters. Feeding areas are those that concentrate pelagic crustaceans (e.g., euphausiids) and juvenile fish (primarily juvenile pollock), such as in upwelling regions along the shelf break or fronts on the middle shelf. Known spawning areas in the eastern Bering Sea are: north of Unimak Island, along the mid-shelf front (100m isobath)between Unimak Island and the Pribilof Islands, south of the Pribilof Islands, and possibly at other areas to the north, particularly at heads of submarine canyons. Known spawning areas in the Aleutian Islands are : over deep waters north of Umnak and Unalaska Islands, the region north of the Islands of Four Mountains, through Amukta Pass to Seguam Island, and north of Kanaga and Tanaga Islands. Pollock may prefer waters of 2-3°C for spawning.

## EFH Definition for BSAI Pacific Cod

**Eggs(duration 15-20 days) - Level $0_a$**
Areas of mud and sand on the inner, middle, and outer continental shelf and upper slope throughout the eastern Bering Sea and Aleutian Islands in winter and spring.

**Larvae (duration unknown)- Level $0_a$**
Epipelagic waters throughout the eastern Bering Sea and Aleutian Islands regions in winter and spring.

**Early Juveniles (up to 2 years) - Level $0_a$**
Areas of mud and sand and the water column on the inner and middle continental shelf of the eastern Bering Sea and Aleutian Islands, particularly those with mysids, euphausiids and shrimp.

**Late Juveniles (2-4 years) - Level 1**
Areas of soft substrate (clay, mud, and sand) and the lower portion of the water column on the inner, middle, and outer continental shelf areas of the eastern Bering Sea and Aleutian Islands, particularly those with mysids, euphausiids, shrimp, pollock, flatfish, crab, and fishery discards.

**Adults (4+ years old) - Level 2**
Areas of mud and sand along the inner, middle, and outer continental shelf up to 500m along with the lower portion of the water column of the eastern Bering Sea and Aleutian Islands. Spawning occurs in January-May near the bottom across broad areas of the shelf, but predominately along the outer shelf between 100-200 m in the eastern Bering Sea, and throughout the area<200m in the Aleutian Islands. After spawning, the mature population spreads out throughout the shelf in the eastern Bering Sea and Aleutian Islands, but with concentrations along the outer shelf northwest of the Pribilof Islands and along the outer and middle shelf areas northwest of the Alaskan Peninsula and into Bristol Bay. Feeding areas are those containing pollock, flatfish, and crab.

**EFH Definition for BSAI Yellowfin Sole**

**Eggs (duration unknown)- Level $0_a$**
Pelagic inshore waters of the southeastern Bering Sea shelf from Norton Sound to Bristol Bay in spring and summer.

**Larvae (duration 2-3 months) - Level $0_a$**
Pelagic inshore waters of the southeastern Bering Sea shelf from Norton Sound to Bristol Bay in spring, summer and fall.

**Early Juveniles (to 5.5 years old) - Level $0_a$**
Demersal areas (bottom and lower portion of the water column) on the inner, middle and outer portions of the continental shelf (down to 250 m) and within nearshore bays of the eastern Bering Sea.

**Late Juveniles (5.5 - 9 years old) - Level 1**
Areas of sandy bottom along with the lower portion of the water column within nearshore bays and on the inner, middle and outer portions of the continental shelf (down to 250 m) of the eastern Bering Sea south of St Matthew Island (approximately 61° N) and in Norton Sound. Feeding areas would be those containing polychaetes, bivalves, amphipods and echiurids.

**Adults (9+ years old) - Level 2**
Areas of sandy bottom along with the lower portion of the water column on the inner, middle and outer portions of the continental shelf (down to 250 m) of the eastern Bering Sea south of St. Matthew Island (approximately 61° N) and in Norton Sound. Areas of known concentrations vary seasonally. Adult spawning areas in summer (May-August) are located along the inner shelf from Cape Constantine to Cape Peirce, throughout Kuskokwim Bay, and North of Nunivak Island. Summer (June-October) feeding concentrations of adults are located along the inner and middle portions of the shelf from Kuskokwim and Bristol Bays south along the Alaskan Peninsula to Amak Island, and northwest to St. Matthew Island. Feeding areas would be those containing polychaetes, bivalves, amphipods and echiurids. In winter, yellowfin sole adults migrate to deeper waters of the shelf (100-200 m) south of 60°N to the Alaskan Peninsula.

## EFH Definition for BSAI Greenland Turbot

**Eggs (duration unknown)- Level $0_a$**
Benthypelagic waters of the outer continental shelf and slope in the eastern Bering Sea and throughout the Aleutian Islands**.**

**Larvae (8-9 months) - Level $0_a$**
Pelagic waters of the outer continental shelf, slope, and adjacent basin in the eastern Bering Sea and throughout the Aleutian Islands.

**Early Juveniles (to 4 years old) - Level $0_a$**
Substrate and lower portion of the water column of the inner, middle and outer portions of the continental shelf and the adjacent upper slope region of the eastern Bering Sea and throughout the Aleutian Islands.

**Late Juveniles (4 - 5 years old) - Level 1**
Substrate (particularly mud and muddy-sand) and lower portion of the water column of the middle and outer continental shelf and adjacent upper and lower slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Feeding areas would be those containing euphausiids, polychaetes, and small fish.

**Adults (5+ years old) - Level 2**
Substrate (particularly mud and muddy-sand) and lower portion of the water column of the outer continental shelf and adjacent upper and lower slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Feeding areas would be those containing pollock and small fish.

## EFH Definition for BSAI Arrowtooth flounder

**Eggs (duration unknown)- Level $0_a$**
Pelagic waters of the middle and outer continental shelf and slope in the eastern Bering Sea and throughout the Aleutian Islands in winter.

**Larvae (duration 2-3 months) - Level $0_a$**
Pelagic waters of the inner, middle and outer continental shelf and adjacent nearshore bays in the eastern Bering Sea and throughout the Aleutian Islands.

**Early Juveniles (to 2 years old) - Level $0_a$**
Areas of gravel, sand and mud and the associated water column of the inner continental shelf and the adjacent nearshore bays in the eastern Bering Sea and throughout the Aleutian Islands.

**Late Juveniles (2 - 4 years old) - Level 1**
Areas of gravel, sand and mud and the associated water column of the middle and outer continental shelf and adjacent upper slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Feeding areas would be those containing euphausiids, crustaceans, and small fish.

**Adults (4+ years old) - Level 2**
Areas of gravel, sand and mud and the associated water column of the middle and outer continental shelf and adjacent upper slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Summer feeding areas on the middle and outer shelf would be those containing gadids, euphausiids, and other fish. Spawning areas in winter are on the outer shelf and upper slope regions.

## EFH Definition for BSAI Rock Sole

**Eggs (duration unknown) - Level $0_a$**
Areas of pebbles and sand on the middle and outer continental shelf in the eastern Bering Sea in winter (December-March).

**Larvae (duration 2-3 months) - Level $0_a$**
Pelagic waters of the eastern Bering Sea over the inner, middle and outer continental shelf, the slope, and the Aleutian Basin.

**Early Juveniles (to 3.5 years old) - Level $0_a$**
Inner, middle and outer portions of the continental shelf along with the lower portion of the water column of the eastern Bering Sea south of 61°N and in Norton Sound. Feeding areas would be those containing polychaetes, bivalves, amphipods and crustaceans.

**Late Juveniles (3.5 - 8 years old) - Level 1**
Areas of pebbles and sand along with the lower portion of the water column within nearshore bays and on the inner, middle and outer portions of the continental shelf of the eastern Bering Sea south of 61° N and in Norton Sound. Feeding areas would be those containing polychaetes, bivalves, amphipods and crustaceans.

**Adults (8+ years old) - Level 2**
Areas of pebbles and sand along with the lower portion of the water column on the inner, middle and outer portions of the continental shelf of the eastern Bering Sea south of 61° N and in Norton Sound. Areas of known concentrations vary seasonally and include adult spawning areas in winter and feeding areas in summer (May-October), which include Bristol Bay, portions of outer Kuskokwim Bay, north of the Alaskan Peninsula to Unimak Island, and near the Pribilof Islands. Feeding areas would be those containing polychaetes, bivalves, amphipods and crustaceans.

## EFH Definition for BSAI Other Flatfish - Alaska plaice

**Eggs (duration unknown)-Level $0_a$**
Pelagic waters of the middle and outer continental shelf of the eastern Bering Sea in spring and early summer.

**Larvae (duration 2-4 months)-Level $0_a$**
Pelagic waters of the inner, middle and outer continental shelf of the eastern Bering Sea in summer and fall.

**Early Juveniles (up to 4 years)-Level $0_a$**
Substrate (particularly areas of sand and mud) and lower portion of the water column on the inner and middle continental shelf of the eastern Bering Sea.

**Late Juveniles (4-7 years)-Level 1**
Substrate (particularly areas of sand and mud) and lower portion of the water column on the inner, middle and outer continental shelf of the eastern Bering Sea. Feeding areas will be those containing polychaetes, amphipods, and echiurids. With increasing age, plaice overwinter near the edge of the shelf, and return to the middle and inner shelf for feeding in spring, summer and fall.

**Adults (7+ years)- Level 2**
Substrate (particularly areas of sand and mud) and lower portion of the water column on the inner, middle and outer continental shelf of the eastern Bering Sea. Feeding areas will be those containing polychaetes, amphipods, and echiurids. Overwinters near the edge of the shelf in the southeastern Bering Sea from the

Pribilof islands to Unimak Island and north along the Alaskan peninsula. Occurs across broad areas of the middle and inner shelf on summer and fall.

## EFH Definition for BSAI Flathead Sole

**Eggs (duration unknown)- Level $0_a$**
Pelagic waters of the middle and outer portions of the southeastern Bering Sea shelf, adjacent slope and basin waters, and throughout the Aleutian Islands in winter and early spring.

**Larvae (duration unknown)- Level $0_a$**
Pelagic waters of the inner, middle, and outer portions of the southeastern Bering Sea shelf, adjacent slope and basin waters, and throughout the Aleutian Islands in spring and summer.

**Early Juveniles (to 2 years old) - Level $0_a$**
Bottom substrate and lower water column on the inner, middle and outer portions of the southeastern Bering Sea shelf and throughout the Aleutians Islands.

**Late Juveniles (2 - 3 years old) - Level 1**
Bottom substrate (particularly sand and mud) and lower portion of the water column on the inner, middle, and outer portions of the southeastern Bering Sea shelf south of 61°N and throughout the Aleutian Islands. Feeding areas would be those containing polychaetes, bivalves, ophiuroids, pollock, small tanner crab and other crustaceans.

**Adults (3+ years old) - Level 2**
Bottom substrate (particularly sand and mud) and lower portion of the water column on the inner, middle, and outer portions of the southeastern Bering Sea shelf south of 61°N and throughout the Aleutian Islands. Feeding areas, primarily on the inner, middle and outer shelf in spring, summer and fall, are those containing polychaetes, bivalves, ophiuroids, pollock, small tanner crab and other crustaceans. Spawning areas in winter and early spring are located primarily on the outer shelf.

## EFH definition for BSAI Sablefish

**Eggs (duration 14-20 days)- Level $0_a$**
Pelagic waters of the upper and lower slope, and basin areas from 200-3000 m from late winter to early spring (December-April) in the eastern Bering Sea and Aleutian Islands.

**Larvae (duration up to 3 months)-Level $0_a$**
Epipelagic waters of the middle and outer continental shelf, the slope and basin areas in the eastern Bering Sea and Aleutian Islands during late spring-early summer months (April - July).

**Early Juveniles (up to 2 years)- Level $0_a$**
Pelagic waters, during first summer, along the outer, middle, and inner continental shelf of the eastern Bering Sea and Aleutian Islands. Areas of soft-bottom in nearshore bays and island passes after the first summer until end of second summer.

**Late Juveniles (2-5 years)- Level 1**
Areas of soft bottom deeper than 200m associated with the continental slope and deep shelf gulleys and fjords (presumably within the lower portion of the water column) of the eastern Bering Sea and Aleutian Islands. Feeding areas are those containing mesopelagic and benthic fishes, benthic invertebrates and jellyfish.

**Adults (5+years)- Level 2**
Areas of soft bottom deeper than 200m (presumably within the lower portion of the water column) associated with the continental slope and deep shelf gulleys in the eastern Bering Sea and Aleutian Islands. Feeding areas would be those containing mesopelagic and benthic fishes, benthic invertebrates and jellyfish. A large portion of the adult diet is comprised of gadid fishes mainly pollock.

## EFH definition for BSAI Pacific Ocean Perch

**Eggs (internal incubation, ~90days) No EFH definition determined.**
Internal fertilization and incubation. Incubation is assumed to occur during the winter months.

**Larvae (duration 60-180 days)- Level $0_a$**
Pelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas of the Bering Sea and Aleutian Islands, during the spring and summer months.

**Early Juveniles (larval stage to 3 years) - Level $0_a$**
Initially pelagic, then demersal in very rocky areas of the inner continental shelf of the Bering Sea and Aleutian Islands. Includes the water column.

**Late Juveniles (3 to 10 years) - Level 1**
Areas of cobble, gravel, mud, and sand along the inner, middle, and outer continental shelf and upper slope areas, shallower than adults, and the middle and lower portions of the water column of the Bering Sea and Aleutian Islands Regions. Feeding areas are those containing euphausiids.

**Adults (10+ years)- Level 1**
Areas of cobble, gravel, mud, and sand along the outer continental shelf and upper slope areas and middle and lower portions oft the water column of the Bering Sea and Aleutian Islands. Feeding areas are those containing euphausiids. Areas of high concentrations tend to vary seasonally and may be related to spawning behavior. In summer, adults inhabit shallower depths (180-250m) and in the fall they migrate farther offshore (300-420m).

## EFH definition for BSAI POP complex, Shortraker and Rougheye rockfish

**Eggs - No EFH definition determined.**
Internal fertilization and incubation.

**Larvae (duration unknown)- Level $0_b$**
Epipelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas of the Bering Sea and Aleutian Islands, during the spring and summer months.

**Early Juveniles - Level $0_{a-b}$**
Pelagic waters and substrate on the entire continental shelf of the Bering Sea and Aleutian Islands Regions.

**Late Juveniles - Level $0_b$ and level 1**
Areas shallower than adult along the continental shelf of the Bering Sea and Aleutian Islands Regions. Juvenile shortraker rockfish have been only rarely seen.

**Adults (15+ years)-Level 1**
Areas of mud, sand, rock, cobble, and gravel and the lower portion of the water column on the outer continental shelf and upper slope of the Bering Sea and Aleutian Islands. Fishery concentrations at 100-500 m. Feeding areas would be those areas where shrimps, squid and myctophids occur.

**EFH definition for BSAI POP complex, Northern rockfish**

**Eggs- No EFH definition determined.**
Internal fertilization and incubation.

**Larvae- Level $0_b$**
Pelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas extending to the seaward boundary of the EEZ of the Bering Sea and Aleutian Islands, during the spring and summer months.

**Early juveniles (up to 25cm)-Level $0_b$**
Pelagic waters and substrate of the inner, middle, and outer continental shelf of the Bering Sea and Aleutian Islands.

**Late Juveniles (greater than 25 cm)-Level 1**
Areas of cobble and rock along the shallower regions (relative to adults) of the outer continental shelf of the Bering Sea and Aleutian Islands.

**Adults (13+years)- Level 1**
Areas of cobble and rock along the outer continental slope and upper slope regions and the middle and lower portions of the water column of the Bering Sea and Aleutian Islands. Areas of relatively shallow banks of the outer continental shelf have been found to have concentrated populations.

**EFH definition for BSAI Other rockfish, Dusky rockfish**

**Eggs-No EFH definition determined.**
Internal fertilization and incubation.

**Larvae- Level $0_b$**
Pelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas extending to the seaward boundary of the EEZ of the Bering Sea and Aleutian Islands, during the spring and summer months.

**Early juveniles (up to 25cm)-Level $0_b$**
Pelagic waters of the inner, middle, and outer continental shelf of the Bering Sea and Aleutian Islands.

**Juveniles (greater than 25cm)- Level $0_a$**
Areas of cobble, rock and gravel and the water column along the inner, middle, and outer continental shelf of the Bering Sea and Aleutian Islands..

**Adults (up to 50 years) -Level 1**
Areas of cobble, rock and gravel along the outer continental shelf and upper slope region and the middle and lower portions of the water column of the Bering Sea and Aleutian Islands. Feeding areas are those containing euphausiids.

## EFH definition for BSAI Other rockfish, Thornyhead rockfish

**Eggs- Level $0_a$**
Pelagic waters of the Bering Sea and Aleutian Islands during the late winter and early spring.

**Larvae (duration <15 months)- Level $0_a$**
Pelagic waters of the Bering Sea and Aleutian Islands.

**Juveniles (> 15 months)- Level $0_a$**
Areas of mud, sand, rock, cobble, and gravel and the lower portion of the water column along the middle and outer continental shelf and upper slope of the Bering Sea and Aleutian Islands.

**Adults (12+ years)- Level 1**
Areas of mud, sand, rock, cobble, and gravel and the lower portion of the water column along the middle and outer continental shelf and upper and lower slope of the Bering Sea and Aleutian Islands. Feeding areas are those containing shrimp, fish (cottids), and small crabs.

## EFH Definition for BSAI Atka mackerel

**Eggs (duration 1-1.5 months)-Level $0_a$**
Areas of gravel, rock and kelp in shallow water in island passes, nearshore, and on the inner continental shelf in the Aleutian Islands and south eastern Bering Sea in areas of swift current in summer.

**Larvae (duration 1.5-6 months) -Level $0_a$**
Epipelagic waters of the outer continental shelf of the southeastern Bering Sea and Aleutian Islands, the Aleutian Basin (to the edge of the EEZ), and in the adjacent North Pacific Ocean (to the edge of the EEZ) in fall and winter.

**Juveniles (up to 3 years)- Level $0_b$**
Unknown habitat association; assumed to settle near areas inhabited by adults, but have not been observed in fishery or surveys.

**Adults (3+ years)-Level 2**
Areas of gravel, rock and kelp on the inner, middle and outer portions of the shelf in the Aleutian Islands and the entire water column to the surface. Areas of gravel and rock on the outer portion of the shelf in the SE Bering Sea and extending nearshore near the Pribilof Islands, including the entire water column. Feeding areas are those containing copepods, euphausiids and meso-pelagic fish (myctophids). Spawning occurs in nearshore (inner shelf and in island passes) rocky areas and in kelp in shallow waters in summer. Move to offshore deeper areas nearby in winter. Perform diurnal/tidal movements between demersal and pelagic areas.

## EFH Definition for BSAI Other species- Sculpins

**Eggs - Level $0_a$**
All substrates on the inner, middle and outer continental shelf of the eastern Bering Sea and Aleutian Islands. Some species deposit eggs in rocky shallow waters near shore.

**Larvae- Level $0_a$**
Pelagic waters of the inner, middle and outer continental shelf and slope of the eastern Bering Sea and Aleutian Islands, predominately over the inner and middle shelf.

**Juveniles - Level $0_a$**
Broad range of demersal habitats from intertidal pools, all shelf substrates (mud, sand, gravel, etc.) and rocky areas of the upper slope of the eastern Bering Sea and Aleutian Islands.

**Adults - Level 1**
Broad range of demersal habitats from intertidal pools, all shelf substrates (mud, sand, gravel, etc.) and rocky areas of the upper slope of the eastern Bering Sea and Aleutian Islands.

## EFH Definition for BSAI Other Species -Skates

**Eggs-Level $0_a$**
All bottom substrates of the slope and across the shelf throughout the eastern Bering Sea and Aleutian Islands.

**Larvae- No EFH definition determined.**
Not applicable (no larval stage)

**Juveniles-Level $0_a$**
Broad range of substrate types (mud, sand, gravel, and rock) and the water column on the shelf and the upper slope of the eastern Bering Sea and Aleutian Islands.

**Adults- Level 1**
Broad range of substrate types (mud, sand, gravel, and rock) and the lower portion of the water column on the shelf and the upper slope of the eastern Bering Sea and Aleutian Islands.

## EFH Definition for BSAI Other Species -Sharks

**Eggs- No EFH definition determined.**
Not applicable (most are oviparous)

**Larvae- No EFH definition determined.**
Not applicable (no larval stage)

**Juveniles and Adults-Level $0_a$**
All waters and substrate types in the inner, middle and outer continental shelf and slope of the Bering Sea and Aleutian Islands.

## EFH Definition for BSAI Other Species -Octopus

**Eggs-Level $0_a$**
All bottom substrates of the shelf throughout the eastern Bering Sea and Aleutian Islands.

**Larvae- No EFH definition determined.**
Not applicable (no larval stage)

**Juveniles and Adults-Level $0_a$**
Broad range of substrate types (mostly rock, gravel, and sand) and the lower portion of the water column on the shelf and the upper slope of the eastern Bering Sea and Aleutian Islands. Feeding areas are those containing crustaceans and molluscs.

## EFH Definition for BSAI Squid - Red Squid

**Eggs-Level $0_a$**
Areas of mud and sand on the upper and lower slope throughout the eastern Bering Sea and Aleutian Islands.

**Larvae- No EFH definition determined.**
Not applicable (no larval stage)

**Juveniles and Adults-Level $0_a$**
Pelagic waters of the shelf, slope and basin to the seaward edge of the EEZ in the eastern Bering Sea and Aleutian Islands. Feeding areas are those containing euphausiids, shrimp, forage fish, and other cephalopods.

## EFH Definition for BSAI Forage fish complex, Eulachon

**Eggs (duration 30-40 days) - Level $0_a$**
Bottom substrates of sand, gravel and cobble in rivers during April-June.

**Larvae (duration 1-2 months) - Level $0_a$**
Pelagic waters of the inner continental shelf throughout the eastern Bering Sea.

**Juveniles (to 3 years of age) - Level $0_a$**
Pelagic waters of the middle and outer continental shelf and upper slope throughout the eastern Bering Sea.

**Adults (3+ years)- Level $0_a$**
Pelagic waters of the middle to outer continental shelf and upper slope throughout the eastern Bering Sea for non-spawning fishes (July-April). Feeding areas are those containing euphausiids and copepods. Rivers during spawning (April-June).

## EFH Definition for BSAI Forage fish complex, Capelin

**Eggs (duration 2-3 weeks) - Level $0_a$**
Sand and cobble intertidal beaches down to 10 m depth along the shores of the eastern Bering Sea in Bristol Bay, Norton Sound, and along the northern shore of the Alaskan Peninsula during May-August.

**Larvae (duration 4-8 months) - Level $0_a$**
Epipelagic waters of the inner and middle continental shelf throughout the eastern Bering Sea.

**Juveniles (1-2 yrs)- Level $0_a$**
Pelagic waters of the inner and middle continental shelf throughout the eastern Bering Sea. May be associated with fronts and ice edges in winter.

**Adults(2+ yrs)- Level $0_a$**
Pelagic waters of the inner, middle and outer continental shelf throughout the eastern Bering Sea during their non-spawning cycle (September-April). Populations associated with fronts and the ice edge formed in winter. Intertidal beaches of sand and cobble down to 10 m depth during spawning (May-August).

## EFH Definition for BSAI Forage fish complex, Sand lance

**Eggs (3-6 weeks) - Level $0_a$**
Bottom substrate of sand to sandy gravel along the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

**Larvae (100-131 days) - Level $0_a$**
Pelagic and neustonic waters along the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

**Juveniles - Level $0_a$**
Soft bottom substrates (sand, mud) and the entire water column of the inner and middle continental shelf throughout the eastern Bering Sea and the Aleutians Islands. Feeding areas contain zooplankton, calanoid copepods, mysid shrimps crustacean larvae, gammarid amphipods and chaetognaths.

**Adults- Level $0_a$**
Soft bottom substrates (sand, mud) and the entire water column of the inner and middle continental shelf throughout the eastern Bering Sea and the Aleutians Islands. Feeding areas contain zooplankton, calanoid copepods, mysid shrimps crustacean larvae, gammarid amphipods and chaetognaths.

## EFH Definition for BSAI Forage fish complex, Myctophids and Bathylagids

**Eggs - Level $0_c$ - No EFH definition determined**
No information available at this time.

**Larvae - Level $0_c$ - No EFH definition determined**
No information available at this time.

**Juveniles - Level $0_a$**
Pelagic waters ranging from near surface to lower portion of water column of the slope and basin regions throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean.

**Adults- Level $0_a$**
Pelagic waters ranging from near surface to lower portion of water column of the slope and basin regions throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean.

## EFH Definition for BSAI Forage fish complex, Sand fish

**Eggs - Level $0_a$**
Egg masses attached to rock in nearshore areas throughout the eastern Bering Sea and the Aleutians Islands.

**Larvae - Level $0_c$ - No EFH definition determined**
No information available at this time.

**Juveniles - Level $0_a$**
Bottom substrates of mud and sand of the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

**Adults- Level $0_a$**
Bottom substrates of mud and sand of the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

## EFH Definition for BSAI Forage fish complex, Euphausiids

**Eggs - Level $0_a$**
Neustonic waters throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean in spring.

**Larvae - Level $0_a$**
Epipelagic waters throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean in spring.

**Juveniles - Level $0_a$**
Pelagic waters throughout the eastern Bering Sea, the Aleutians Islands and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean. Dense populations are associated with upwelling or nutrient-rich areas, such as the edge of the continental shelf, heads of submarine canyons, edges of gullies on the continental shelf, in island passes along the Aleutian Islands and over submerged seamounts.

**Adults- Level $0_a$**
Pelagic waters throughout the eastern Bering Sea, the Aleutians Islands and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean. Dense populations are associated with upwelling or nutrient-rich areas, such as the edge of the continental shelf, heads of submarine canyons, edges of gullies on the continental shelf, in island passes along the Aleutian Islands and over submerged seamounts.

## EFH Definition for BSAI Forage fish complex, Pholids and Stichaeids

**Eggs - Level $0_c$ - No EFH definition determined**
No information available at this time.

**Larvae - Level $0_c$ - No EFH definition determined**
No information available at this time.

**Juveniles - Level $0_a$**
Intertidal to demersal waters of the inner continental shelf with mud substrate throughout the eastern Bering Sea and the Aleutians Islands. Certain species are associated with vegetation such as eelgrass and kelp.

**Adults- Level $0_a$**
Intertidal to demersal waters of the inner continental shelf with mud substrate throughout the eastern Bering Sea and the Aleutians Islands. Certain species are associated with vegetation such as eelgrass and kelp.

## EFH Definition for BSAI Forage fish complex, Gonostomatids

**Eggs - Level $0_c$ - No EFH definition determined**
No information is available at this time.

**Larvae - Level $0_c$ - No EFH definition determined**
No information is available at this time.

**Juveniles - Level $0_c$ - No EFH definition determined**
No information is available at this time.

**Adults- Level $0_a$**
Bathypelagic waters throughout the eastern Bering Sea, Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean.

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Yellowfin Sole (adults and late juveniles)

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